Operational Readiness Clearance Documentation

D0 L1 Calorimeter Upgrade

D0 L1 Calorimeter Group

March 20, 2006

System Contact
Linda Bagby
DAB X3100
bagby@fnal.gov

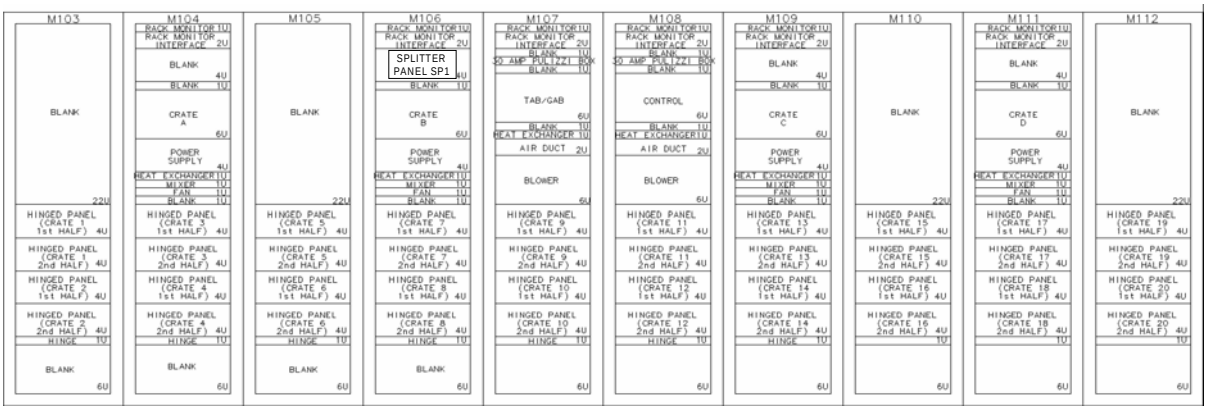
Introduction

The D0 RunIIb L1 Calorimeter upgrade system has been installed in the DZero Assembly Building, DAB, located on the first floor of the counting house. Partial Operation Readiness Clearance of this system, temporarily installed on the sidewalk area of DAB, was obtained November 1, 2005. Modifications to the sidewalk system for installation into the counting house includes a new AC Distribution scheme, increased fuse sizing for the TAB/GAB crate DC power and cards, and the addition of the standard DZero cooling and safety systems in the racks. We seek to obtain unattended operation clearance for the final installation of the L1 Calorimeter Trigger upgrade system.

Rack Layout

The rack layout for this system is provided at http://d0server1.fnal.gov/users/bagby/www/L1_Cal/ORC_Docs/Final_Orc/rack_layout.pdf. Racks M103-M112 contains the electronics for this review. M103 through M105 are duplicates of M110 through M112. The central racks, M105 through M109, house additional ADF crates as well as the TAB/GAB and Control crates.

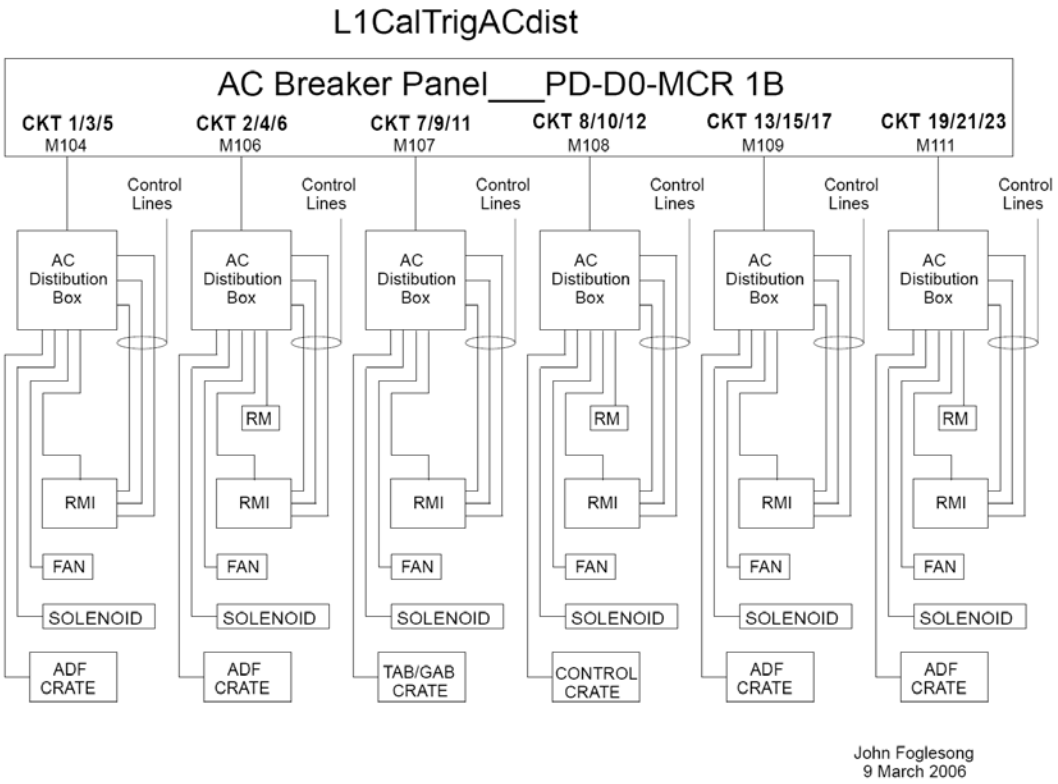
Figure 1: Moving Counting House Rack Layout



AC Distribution and Safety System

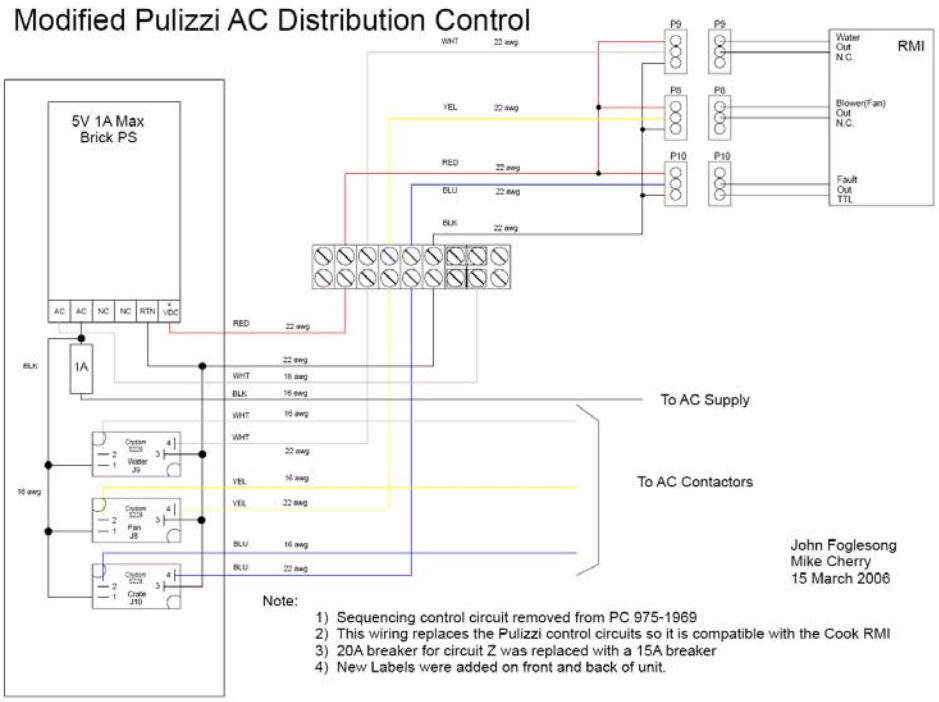
The following block diagram illustrates the AC distribution scheme for the L1 Calorimeter electronics. The AC Distribution box is a Pulizzi PC975-1969 unit. The specifications of this device can be found at http://d0server1.fnal.gov/users/bagby/www/L1_Cal/ORC_Docs/Final_Orc/PC975.pdf. This unit provides power to the ADF, TAB/GAB, and Control crates as well as the crate fan, and rack water solenoid.

Figure 2: AC Distribution Block Diagram



The Pulizzi sequencing control circuit was modified to accommodate the logic required by the standard DZero Cook type Rack Monitor Interface (RMI) unit. The Crydom relay specifications can be found at http://d0server1.fnal.gov/users/bagby/www/L1_Cal/ORC_Docs/Final_Orc/crydom_S2.pdf. The RMI monitors the rack water flow, water drip sensor, smoke detector, and the rack blower. If any sensor trips, crate supply power is removed. In the case of a fire, the rack blower power and supply power is removed. Figure 3 illustrates the modification.

Figure 3: Pulizzi Modification



DC Distribution

DC power distribution for each of the crates is described in the following sections. The ADF and Control crates use commercially available Wiener supply-crate combination units. The TAB/GAB crate also uses a commercially available Wiener supply interfaced to a custom backplane.

ADF Crate

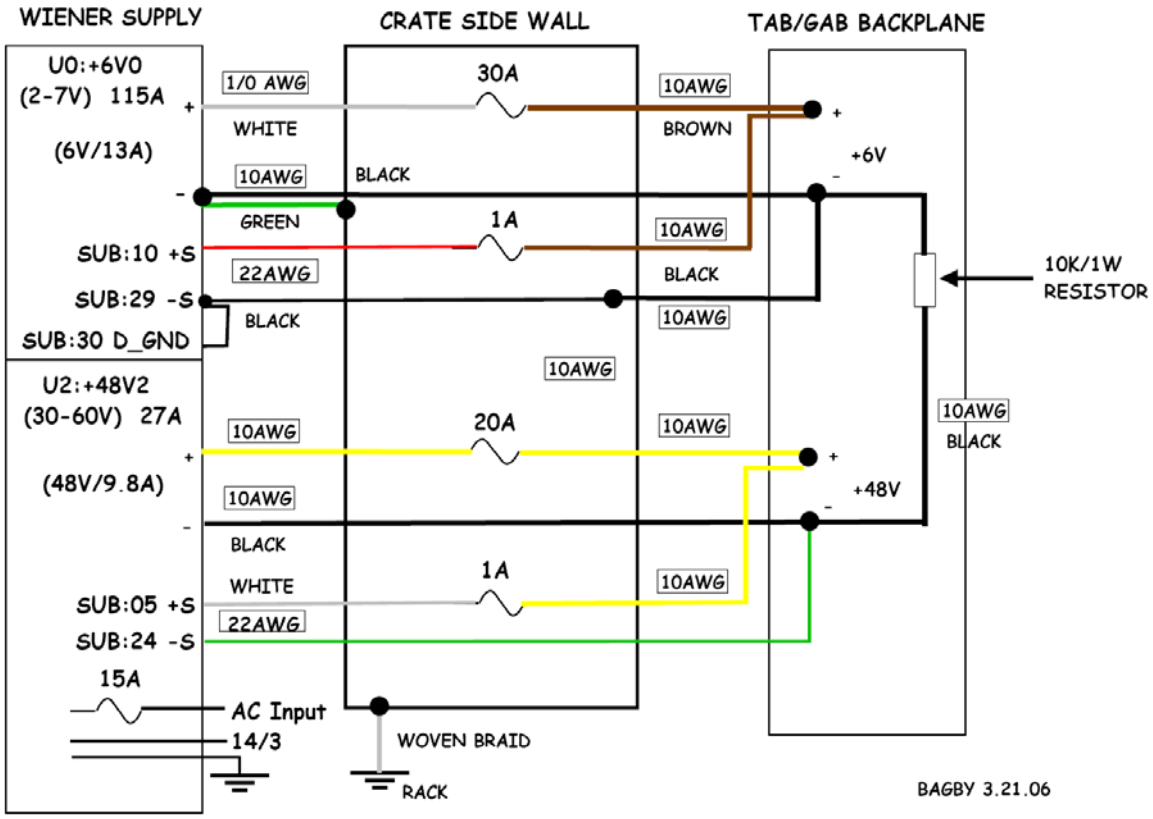
The two new ADF crates installed are identical to the ADF crates reviewed in August. A RMI provides smoke detection interlocks to the supplies and fans. The ADF power scheme utilizes a commercially available Wiener power supply-crate combination unit. The document describing this system can be found at

http://www/pa.msu.edu/hep/d0/ftp//run2b/l1cal/hardware/adf_2/cards_and_crates/safety_review_adf_crates.txt .

TAB/GAB Crate

The TAB/GAB crate is powered by a Wiener type UEP6021 VMEx64 power supply unit. Two modules are installed in the mainframe chassis. U0 provides 2-7V/115A and U2 provides 30-60V/27A. The crate is located in rack M107. Figure 4 illustrates the cable gauge and fusing used to connect the power to the TAB/GAB backplane. U0 operates at 6V, 20A and U2 operates at 48V, 15A.

Figure 4: TAB/GAB Crate DC Power Distribution.



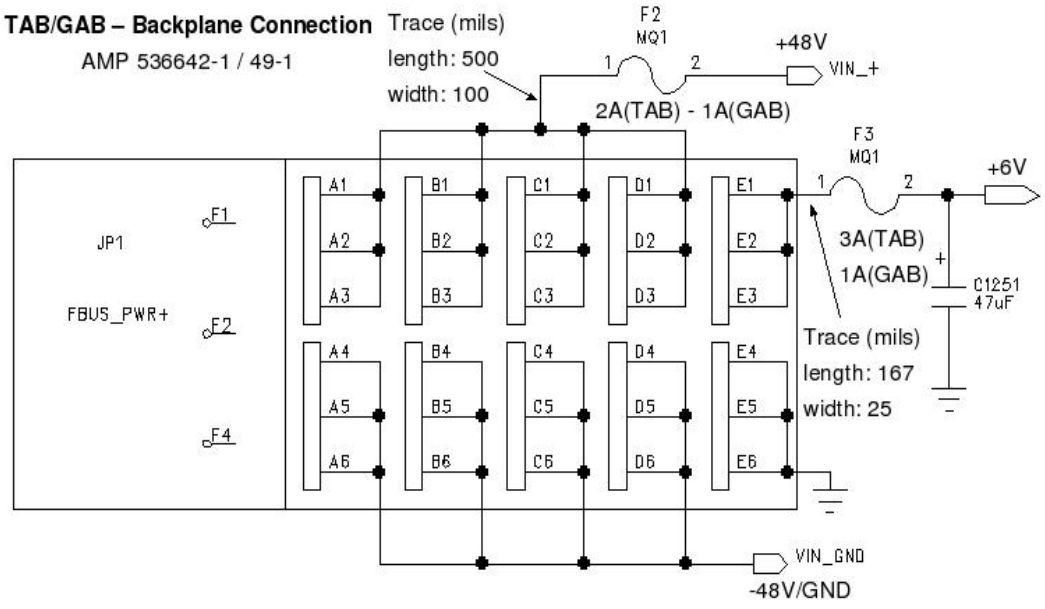
The TAB/GAB crate power supply to backplane connection parameters are shown in the following table. The U0 supply (6V) is connected to the fuse panel with a 1/0 cable rated for 150 A. The maximum current output of the supply is 115A. A 30A fuse protects the 10 AWG cable. The 10 AWG power cable connects to the TAB/GAB backplane with a ring lug termination. The lug is bolted in position over a .0924 in^2 copper surface area resulting in a current density of 318.3 A/in^2. The 48V/20A power connection is made similarly with a current density of 212.2 A/in^2. Both of the connections comply with the 1000A/in^2 limit per the Fermilab Electrical Standards guideline.

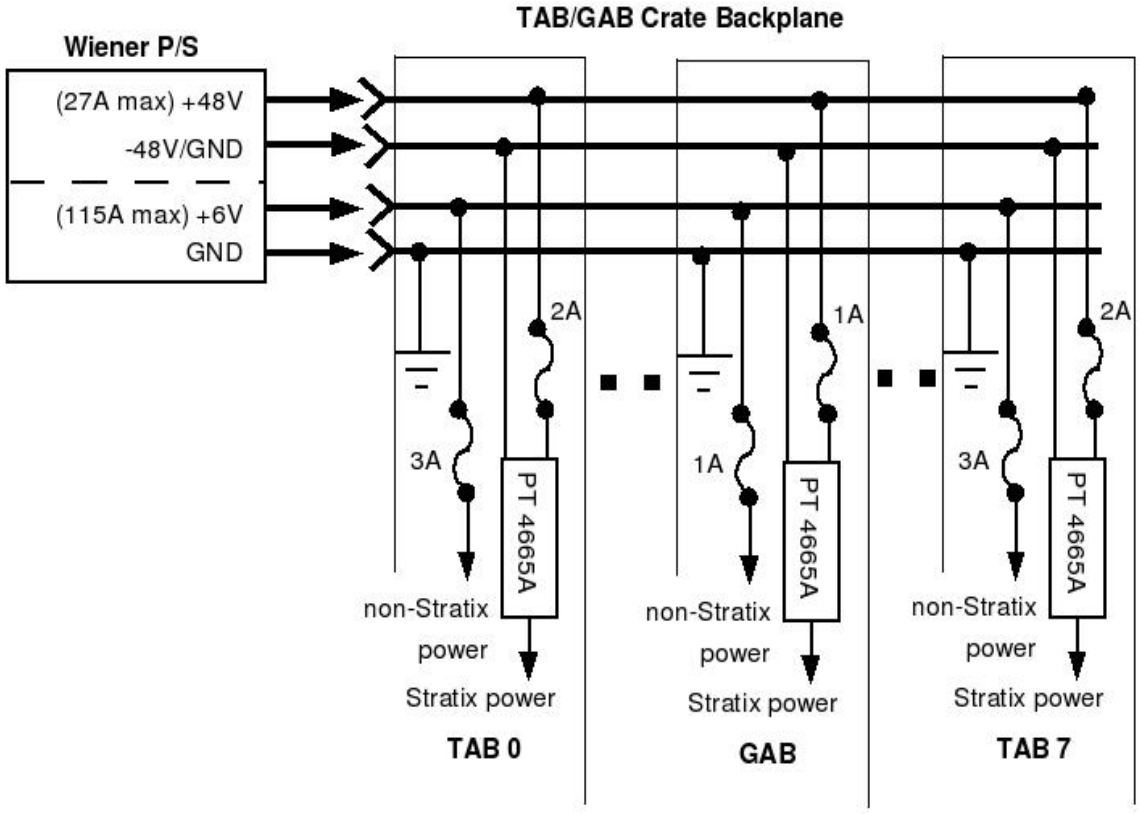
Table 1: TAB/GAB Power Distribution

Power Distribution in the TAB/GAB Crate					
updated		02/24/06			
inch/mil		0.001			
mil/inch		1000			
+6 V					
From	**To**	**Element**	**Current (A)**	**Data**	
PS Cable	Lug	1/0	30.0 per cable		
Lug	Via	compression	318.3 / (in^2)	0.400	0.200 pad / hole diameter (in)
Connector (b'plane)	Connector (tab/gab)	AMP 536649-1	1.11 / pin	27	+6V power pins
Connector (tab/gab)	Fuse	trace		0.167	0.025 length / width (in)
TAB&GAB PS		bulk fuse	30	167	25.000 length / width (mils)
TAB Card		LittleFuse (board)	3		
GAB Card		LittleFuse (board)	1		4,175.000 Area (mil^2)
+48 V					
From	**To**	**Element**	**I (A)**	**Data**	
PS Cable	Lug	10 AWG	20.0 per cable		
Lug	Via	compression	212.2 / (in^2)	0.400	0.200 pad / hole diameter (in)
Connector (b'plane)	Connector (tab/gab)	AMP 536649-1	0.19 / pin	108	+48V power pins
Connector (tab/gab)	Fuse	trace		0.500	0.100 length / width (in)
				500.000	100.000 length/width (mils)
TAB&GAB PS		bulk fuse	20		2oz Cu = 2.69mil
TAB Card		LittleFuse (board)	2		
GAB Card		LittleFuse (board)	1		50,000.000 Area (mil^2)

The current ratings on the press fit pins interfacing the backplane to the TAB and GAB electronics boards meet the guideline requirements. The 6V current density is 1.11A/pin while the 48V current density is .19A/pin, meeting the conservative 1A/pin reference. The TAB boards have 3A fuses on the 6V supply and 2A fuses on the 48V supply to protect the card traces while the GAB boards have 1A fuses for both power inputs. The board traces are sized such that 100A (6V) and 544A for (48V) are required to generate a 60C temperature increase. The TAB/GAB crate electronics board fuse scheme is shown below.

Figure 5: TAB and GAB Board Fusing





Control Crate

The Control Crate power distribution utilizes a Wiener supply-crate combination unit. This crate holds 2 Vertical Interconnect Master cards, an existing design by Fermilab, a commercially available BIT3, and a SCLD (Serial Command Link version D). A complete description of the system can be found at http://www/pa.msu.edu/hep/d0/ftp//run2b/l1cal/hardware/adf_2/cards_and_crates/safety_review_control_crate.txt .

Cooling

The ADF, Control, and TAB/GAB crates are mounted in racks equipped with DZero standard cooling water, heat exchangers and blowers.